The waiting time for inducing orthodontic movement after endodontic treatment, even with perforations

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ABTRACT

The delay period required to start orthodontic movement after endodontic therapy has always raised many questions. This study aimed to reduce these questions, add some considerations into these discussions and suggest a delay period that agrees with the periodontal tissues biology. When the main goals of endodontic treatment are reached, regardless if the tooth presents pulp vitality, pulp necrosis, chronic root lesions or root perforations; 30 days after endodontic treatment, the periodontal tissue is in final repair stages, reorganizing the tissue to restore its physiology and anatomy, even though this process does not occur in such manner, since mineralization is incipient. Orthodontic forces should not biologically interfere with tissue repair, with the pathogenic and virulent microbes involved in pulp necrosis, with chronic periapical lesions and with perforated roots due to endodontic treatment.

Keywords: Endodontics-Orthodontics. Orthodontic movement. Periapical repair. Endodontic repair.

» The author reports no commercial, proprietary, or financial interest in the products or companies described in this article.

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Received: November 21, 2012. Accepted: December 5, 2012.

How to cite this article: Consolaro A. The waiting time for inducing orthodontic movement after endodontic treatment, even with perforations. Dental Press Endod. 2012 Oct-Dec;2(4):11-4.

Introduction

In discussions and planning of clinical cases, several questions arise and the literature does not provide precise answers or well-defined guidelines. It may be the lack of experimental data to substantiate stronger assumptions, or the lack of reports of a large sample with a standardized protocol.

While these two circumstances are not resolved, our conduits and protocols must be based on clinical experience and knowledge acquired by the similarity of biologically correlated scenarios.[1,2] Another way to define guidelines in the absence of experimental data and large sample reports is by applying the basic knowledge of general principles[1,2] to a specific situation.

To understand what would be the delay period required to move a tooth that has been endodontically treated — regardless of pulp vitality, pulp necrosis, perforation or chronic periapical lesions — it is necessary to review how the periodontal healing occurs.

The periodontal repair of the lateral root surface in teeth with pulp vitality

Like other tissues, the periodontal ligament remodeling happens by the mechanism of tissue repair, which can be have smaller or greater extent depending on the damage. The granulation tissue, after filling in the injured area, differentiates into mature connective tissue, restoring its previous anatomy and physiology.

This occurs when:

1. A periodontal surgery on a lateral root surface with no involvement of the gingival or pulpal tissues, and scaling of the root are performed.
2. An orthodontic mini-implant have pierced or slipped onto the root surface, thus forming a blood clot, which will fill the injured wall with a fibrin net, which will bond platelets and inflammatory cells.

The platelets and macrophages in the clot are the main sources of mediators that stimulate adjacent cells to proliferate. Simultaneously:

a. The adjacent endothelial cells form buds and form new blood vessels, which infiltrate the blood clot in a similar to a blood supply network manner.
b. The surrounding bone cells, as young osteoblasts and osteoblast forming cells, proliferate and migrate to infiltrate the clot.
c. The cementoblasts and cementoblast forming cells, differentiate and migrate toward the center of the uncovered root surface.
d. Epithelial cells rests of Malassez proliferate and form new filaments and islets at the area.

Three to four days into maturation, the blood clot was been replaced by granulation tissue rich in blood vessels, young differentiated cells and extracellular matrix. The osteoblasts deposit alveolar bone, the fibroblasts release organized collagen fibers and the peptidoglycans matrix of the periodontal ligament, and the cementoblasts restore the cells layers of the uncovered portion of the root, depositing new cementum layers to attach the new periodontal fibers being produced.

In one to two weeks, depending on the size of the lesion, the full restoration of periodontal tissues happens and the tissue has regained its physiologic functions. In most cases, radiographic images of the repair cannot yet be obtained, because the level of mineralization may not be sufficient at this point.

During the period when the tooth root becomes exposed to the blood clot and granulation tissue, some clasts migrate and settle to reabsorb the cementum and/or dentin surface. Once the cell migration and differentiation happens in the granulation tissue, the pH returns to normal and the area is no longer an acid environment, such as in acute inflammation. In normal or basic pH, these clasts demobilize and migrate from the area, leaving the binding protein surfaces, which stimulate the migration and synthesis of new cementoblastic cells.[1,2]

Following the complete periodontal repair of the resorption area, especially by a tomographic and microscopic standpoint, one can observe small contour defects on the root surface and the periodontal space, which does not affect the physiology of the area.

The periodontal repair of the root surface at the apical foramen region after endodontic therapy

The following factors should be considered in the proposed situation:

» Endodontic treatment was performed after a bio pulpectomy, or
» Pulp necrosis with root canal contamination, but controlled infection and no evident lesion, or

» Existing chronic periapical lesions and controlled or eliminated infection by root canal therapy and / or medication, or
» The majority of canals adequately treated develop to cure. In some cases, the repair happens in approximately 90% of endodontically treated cases, even with chronic periapical lesions associated.

If the infection was controlled and the endodontic technique was properly performed, with no chemical irritation or periapical residues, the apical periodontal tissues tend to respond through the same process described on the topic above, where there wasn't an apical foramen.

However, some filling materials do not allow for cementoblast colonization on its surface, due to their toxicity and/or physicochemical characteristics. In such cases, macrophages and multinucleated giant cells will accumulate on their surface, which will try to slowly phagocyte these materials indefinitely. This macrophage accumulation around the filling material in the apical region is called a foreign body granuloma, and it is restricted to that specific area of the surface, allowing the repair to continue normally at the adjacent areas.

Some dental materials, however, such as those with a calcium hydroxide and MTA base, allow the cementoblasts to colonize their finely coagulated proteins coated surface due to their basic pH. In this scenario, the cementoblastic layer deposits cementum with different organization levels, allowing the reinsertion of the periodontal collagen fibers. A few weeks later it is possible to microscopically observe a mineralized barrier of cementum "sealing" or covering what was once the opening of the apical foramen. The cementum is often cellularized, rich in blood vessels canals, and irregularly deposited. In such cases, it is commonly called osteocementum, cementoid or neocementum, and its primary functions are to line the dentin surface and to serve as attachment to the periodontal collagen fibers.

The periodontal repair of the root surface after root canal perforation

When there is a root canal perforation, we can biologically compare it with an apical foramen.

In those cases, there are some questions that must be answered, such as the following.

1. Is the structure (dentin, cementum and periodontal ligament) in the perforated area contaminated?
2. Has the removal of foreign bodies, tissue micro fragments and materials been performed?
3. Was the decontamination of the entire area performed by appropriate therapeutic techniques?
4. Has calcium hydroxide or MTA been used?
5. Has no communication with the outer surface, especially in the furcation region, been achieved?

If the answers to those questions are positive, the clinician may think; "I did my best and in 2 to 4 weeks the region will be fully repaired". The periodontal ligament will behave as it does in the apical foramen area, after canal obturation and after eliminating the infection causes, as we described in the previous section.

The timeline of periodontal repair after endodontic therapy and the orthodontic movement

The granulation tissue develops into mature connective tissue very quickly in small areas. One month after the repair process is established is a long time considering the dimensions of these structures. During this period, the activity in the area is limited to tissue synthesis and reorganization, provided that the infection causes, foreign bodies and necrotic tissues are eliminated or controlled.[1,2]

The forces of the orthodontic movement do not compare to those of a dental trauma or to occlusal trauma forces. They are much lighter, gently applied

and distributed. For that reason, professionals can smoothly move a tooth 30 days after a proper executed endodontic treatment. It is not necessary to wait until the bone and periodontal repair are visually noticeable, as it was previously suggested.

The orthodontic forces do not have influence on microbial colonies or on the repair process, because they are slow and light forces.[1] If chronic periapical lesion or a perforation does not repair, one should not attribute the failure to the forces applied. The cause of the failure should be considered periodontal or endodontic, not orthodontic. In fact, orthodontic treatment could be initiated directly after endodontic therapy, but it is always wise to wait for a month period to assure that the repairing process occurs and is in its final maturation stage.

In clinical endodontic practices, everyone recognizes that the failure rate in the treatment of teeth with chronic periapical lesions is higher than in other scenarios. This occurs:

1) Due to the greater likelihood that microbial biofilms are located in the external apical surfaces, where the access is more difficult to mechanical decontamination and endodontic medication.
2) Due to the presence of frequent external apical resorption, which increases the inaccessibility of instruments and drugs to the microbial biofilm.

In cases of teeth with chronic periapical lesions that were treated endodontically and also orthodontically moved, failures must be attributed to endodontic and morphological factors, and not the fact that the teeth were subjected to light and dissipating orthodontic forces.

There is a very important factor should be emphasized: when a tooth is moved, a lateral root dentin-cementum resorption may occur, including in areas of repaired perforations. In this process, there may be a rearrangement in the region or even a reactivation of the inflammatory process, due to the exposure of hidden bacteria and/or their products by this lateral resorption. In general, after the movement is ceased, this condition goes back to normal, because the required sealing reoccurs. In rare cases, in which this may happen without a subsequent repair, even after the orthodontic movement has ceased, one should repeat the endodontic treatment. Although it rarely happens, the patient should be warned of this possibility.

Final consideration

When the main goals of endodontic treatment are reached:

1) Control and elimination of infectious agents.
2) Absence of foreign bodies.
3) No chemical irritation of the area by used dental materials.

Regardless if the tooth presents pulp vitality, pulp necrosis, chronic root lesions or root perforations; 30 days after endodontic treatment, the periodontal tissue is in final repair stages, reorganizing the tissue to restore its physiology and anatomy, even though this process does not occur in such manner, since mineralization is incipient.

The orthodontic forces are very light and dissipating, and incomparably smaller and different from those found in dental trauma and occlusal trauma. Orthodontic forces should not biologically interfere with tissue repair, with the pathogenic and virulent microbes involved in pulp necrosis, with chronic periapical lesions and with perforated roots due to endodontic treatment.

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